IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

POLAROID CORPORATION,

    Plaintiff and Counterclaim Defendant,

      v.

HEWLETT-PACKARD COMPANY,

    Defendant and Counterclaim Plaintiff.

C.A. No. 06-738-SLR

REDACTED

DEFENDANT HEWLETT-PACKARD COMPANY'S OPPOSITION TO PLAINTIFF POLAROID CORPORATION'S MOTION TO EXCLUDE DR. RANGARAJ RANGAYYAN'S OPINIONS CONCERNING OBVIOUSNESS

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I.   **NATURE AND STAGE OF THE PROCEEDING**

This is a patent infringement case. Plaintiff, Polaroid Corporation ("Polaroid"), alleges

that defendant, Hewlett-Packard Company ("HP"), infringes Claims 1-3 and 7-9 of U.S. Patent

No. 4,829,381 (the "'381 patent"). Fact and expert discovery have been conducted. Claim

construction has been briefed.

Hewlett-Packard has retained an expert in digital image processing, Dr. Rangaraj

Rangayyan, to evaluate the validity of the asserted claims of the '381 patent. Dr. Rangayyan is a

professor at the University of Calgary specializing in digital image processing. He has submitted

two reports totaling over one-hundred and sixty pages in which he sets forth his opinion that,

under the claim constructions proposed by Polaroid and the claim constructions urged by HP, the

asserted claims of the '381 patent are invalid. Dr. Rangayyan's reports contain detailed

mappings of each element of the asserted claims to multiple prior art references. Based on his

analysis, he concludes that the asserted claims are both anticipated and obvious in light of

various prior art references.

Polaroid has submitted an expert report by Dr. Peggy Agouris in which she states her

opinions with respect to alleged infringement of the asserted claims of the '381 patent. In

that report, Dr. Agouris makes various assertions regarding the scope of the relevant claims of

the '381 patent. Dr. Agouris submitted a second report in which she responds to, and purports to

rebut, Dr. Rangayyan's invalidity report. Both Dr. Agouris and Dr. Rangayyan have been

deposed.

Polaroid has filed a Motion captioned: Polaroid's *Daubert* Motion To Exclude Dr.

Rangaraj Rangayyan's Opinions Concerning Obviousness. (Polaroid's "Motion" or the "Motion

to Exclude Obviousness Opinions") (D.I. 170). This memorandum is filed in opposition to that

Motion.

II.   SUMMARY OF ARGUMENT

Polaroid's Motion to Exclude Obviousness Opinions should be denied because: (1)

Polaroid's arguments are not properly the subject of a *Daubert* motion and are duplicative of the

arguments made by Polaroid in its Motion for Summary Judgment of Non-Obviousness; and (2)

to the extent necessary to render his opinions, Dr. Rangayyan applied the correct legal standards

regarding the motivation that a person of ordinary skill in the relevant art would have to combine

references.

III.   STATEMENT OF FACTS

A.   Technology Background

Rather than duplicate prior submissions, HP hereby respectfully directs the Court to the

description of the technology recited in Section III(A) of HP's Motion for Summary Judgment of

Non-Infringement or in the Alternative Invalidity.

B.   State of the Art in Digital Image Processing Prior to the '381 Patent

1.   Techniques for transforming digital images were known for decades prior to the filing of

the application that matured into the '381 patent. *See* Expert Report of Dr. Rangaraj Rangayyan

("Rangayyan Report") at D.I. 190 Exhibit A, ¶ 34.

2.   During that period there was wide recognition of the desirability of improving digital

output images by increasing the contrast within areas of an image and thus making details in the

image more visible. *See id.* at ¶ 35. A variety of techniques were developed that addressed this

problem. In many cases, these techniques utilized combinations of the same or similar

components. *See id.*

3.   By 1988, when Polaroid applied for the '381 patent, the field of digital image

enhancement was well established. Widely accepted and utilized textbooks provided detailed

discussions of a variety of approaches to enhancing contrast. These methods included:

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(a)   ways of transforming pixel values that collectively define an image, wherein the pixels have values within a range of possible values determined by the number of bits available to represent each pixel value. *See id.* at ¶¶ 39-40.

(b)   teachings that the contrast between one pixel and pixels in its surrounding area could be calculated by comparing the luminance value of the subject pixel to the average luminance value of the pixels in its immediate surrounding area. *See id.* at ¶ 41.

(c)   teachings regarding the use of a value associated with a neighborhood of pixels (e.g., a pixel and its eight immediate neighbors or, alternatively, a pixel's eight immediate neighbors) to process individual pixels in that neighborhood so as to improve digital images. *See id.* at ¶ 45.

(d) teachings regarding the use of a transformation function having multiple parts, each transforming an input pixel value by a different amount. *See id.* at ¶¶ 46-52.

4.   The art already contained recognition of the utility of power-law gamma functions in contract enhancement, including the utility of selecting between more than one such function in a contrast enhancement algorithm.

5.   For example, U.S. Patent No. 4,489,349 ("Okada" or the "Okada patent," filed herewith as Ex. A to the Declaration of Raymond N. Scott, Jr. ("Scott Decl.")), issued to Takashi Okada on December 18, 1984, almost four years prior to the filing of the application that matured into the '381 patent. The Okada patent describes a way to enhance contrast in images that have very bright or very dark areas. *See* Okada patent at 1:12-36, 2:19-28. Okada states that "natural illumination can have a very wide brightness range and will necessarily have a vast range of contrast scales." *Id.* at 1:13-15. Okada recognized that when a scene contained both very light and very dark areas, contrast within the dark or light sections of an image of that scene "is

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extremely narrow." *Id.* at 1:31-34. For example, where there was a bright area in an otherwise

dark image, contrast within the dark areas would be poor. In such circumstances, the objective

was to improve contrast in the dark areas. The reverse was true when there was a dark area in an

otherwise bright image.

6.   Okada explains that use of a gamma-based function in this way will result in a group of

contrast enhancement functions represented in the Okada patent's Fig. 2, set forth below:
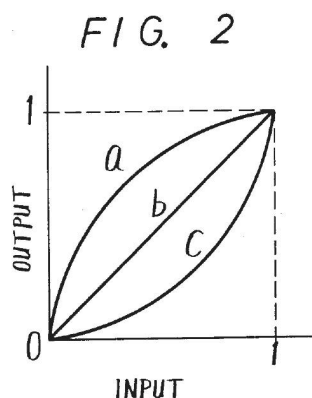
Because the principles underlying Okada and the '381 patent are the same, the curves that

represent the input/output characteristics of the transformations described in the two patents are

the same. *Compare* '381 patent (Scott Decl. Ex. B), Fig. 2, *with* the Okada patent (Scott Decl.

Ex. A), Fig. 2.

7.   In addition to Okada, the prior art contained many examples of the use of the elements of

the asserted claims of the '381 patent. These references include:

- "Digital Image Enhancement and Noise Filtering by Use of Local Statistics," by
  Jong-Sen Lee, (IEEE Transactions on Pattern Analysis and Machine Intelligence,
  Vol. PAMI-2, No. 2, pp. 162-168, March 1980) ("Lee" or the "Lee Reference").
  See Rangayyan Report, ¶¶ 54-62.

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- "Real-Time Adaptive Contrast Enhancement," by Patrenahalli M. Narendra and Robert C. Fitch (IEEE Transaction on Pattern Analysis and Machine Intelligence, VOL. PAMI-3, No. 6, pp. 655-661, November 1981) ("Narendra" or the "Narendra Reference"). *See id.* at ¶¶ 65-72.

- "Digital Image Enhancement: A Survey," by David C. Wang, Anthony H. Vagnucci and C.C. Li, (Computer Vision, Graphics, and Image Processing, Vol. 24, pp. 363-381 (1983)) ("Wang" or the "Wang Reference") was published. *See id*. at ¶¶ 75-81.

- "Feature Enhancement of Film Mammograms using Fixed and Adaptive Neighborhoods," by Gordon R and Rangayyan RM, Applied Optics, 1984, 23(4): 560-564 ("Rangayyan" or the "Rangayyan Reference"). *See id*. at ¶¶ 83-89.

- United States Patent No. 4,654,710 to Christian J. Richard ("Richard" or the "Richard patent") was issued as a patent on March 31, 1987, based on an application filed on January 3, 1986. *See id*. at ¶¶ 101-109.[1]

- United States Patent No. 4,789,933 to Chen *et al.* ("Chen" or the "Chen patent") was issued on December 6, 1988, based on an application filed on February 27, 1987. *See id*. at ¶¶ 111-119.

- United States Patent No. 4,394,688 to Iida *et al.* ("Iida" or the "Iida patent") was issued on July 19, 1983, based on an application filed on August 25, 1981. *See, e.g.* Supplemental Expert Report of Dr. Ranagaraj Rangayyan ("Rangayyan Supplemental Report") at D.I. 190 Exhibit C, ¶¶ 140-155.

8.   On March 14, 2008, HP served the Rangayyan Report on Polaroid.

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[1] HP's expert is a principle author of this prior art reference.

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9.   This report is over one hundred pages long. In text and in detailed claim charts, Dr.

Rangayyan explains his opinion that the asserted claims of the '381 patent are invalid, because

they are anticipated and made obvious by certain prior art references.

10.   In coming to this conclusion, Dr. Rangayyan applied the parties respective claim

constructions, as then articulated. *See, e.g.,* Rangayyan Report, ¶¶ 133-312.

11.   On that same day Polaroid served the expert report of Dr. Peggy Agouris. In that report,

Polaroid advanced certain arguments regarding claim construction and the scope of the asserted

claims that Polaroid had never before stated. *See, e.g.,* Rangayyan Supplemental Report, ¶¶ 10-

34.

12.   On April 18, 2008, HP served Dr. Rangayyan's Supplemental Report, in which he repeats

his invalidity analysis taking into account the novel infringement theories advanced by Polaroid

in Dr. Agouris' report.

13.   Dr. Rangayyan's Supplemental Report again provides detailed explanations as to his

reasoning under both Polaroid's and HP's proposed claim constructions. *See, e.g., id.* at ¶¶ 57-

208.

IV.   ARGUMENT

A.   The Applicable Legal Standards

1.   The Legal Standard for Admissibility of Expert Testimony

In relevant part, Federal Rule of Evidence 702 provides:

> If scientific, technical or other specialized knowledge will assist the trier of fact to
> understand the evidence or to determine a fact in issue, a witness qualified as an
> expert by knowledge, skill, experience, training or education, may testify thereto
> in the form of an opinion or otherwise, if (1) the testimony is based upon
> sufficient facts or data, (2) the testimony is the product of reliable principles and
> methods, and (3) the witness has applied the principles and methods reliably to
> the facts of the case.

Polaroid does not allege that Dr. Rangayyan is not qualified as an expert in the relevant field. He is a well recognized leader in the field and author of one of the relevant prior-art references. Polaroid does not deny that Dr. Rangayyan's opinion is based on sufficient facts or data. Rather, Polaroid argues that his testimony lacks the reliability required by the Fed. R. Evid. 702 because of his alleged failure to apply the correct legal standard with respect to the combination of prior art references that, Dr. Rangayyan explains, make the asserted claims obvious. *See* Polaroid's Motion at 7-9.

Rule 702 confers "to the judge some gatekeeping responsibility in deciding questions of the admissibility of proffered expert testimony." *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 589 (1993). However, "there is significant risk that district judges will set the threshold too high and will in fact force plaintiffs to prove their case twice [once to a Judge and again to a Jury]. Reducing this risk is particularly important because the Federal Rules of Evidence display a preference for admissibility." *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 750 (3d Cir. 1994).

In order to be admissible, profferers of expert testimony need not "demonstrate ... by a preponderance of evidence that the assessments of their experts are correct, they [need] only ... demonstrate by a preponderance of evidence that their opinions are reliable." *Id*. at 744. Instead, a "vigorous cross examination, presentation of contrary evidence, and careful instruction on the burden of proof" are the appropriate means of attacking evidence. *Daubert*, 509 U.S. at 596. Moreover, "[w]hen, as here, the parties' experts rely on conflicting sets of facts [here their characterization of the teaching of the relevant prior art references], it is not the role of the trial court to evaluate the correctness of facts underlying an expert's testimony." *Micro Chemical, Inc. v. Lextron, Inc.*, 317 F.3d 1387, 1392 (Fed. Cir. 2003).

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2.   The Legal Standard for Obviousness

35 U.S.C.§ 103 forbids issuance of a patent when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR International Co. v. Teleflex, Inc.* 127 S. Ct. 1727, 1729 (2007). "An obvious determination is not the result of a ridged formula disassociated from consideration of the facts of the case." *Leapfrog Ent. v. Fisher Price, Inc.*, 485 F.3d 1157, 1161 (Fed. Cir. 2007).

A "patent for a combination which only unites old elements with no change in their respective functions ... obviously withdraws what is already known into the field of its monopoly and diminishes the resources available to skillful men." *KSR Int'l*, 127 S. Ct. at 1739 (*citing Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.,* 340 U.S. 147, 152 (1950)). When a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result to be patentable. *See id.* at 1740 (internal citations omitted); *see also Agrizap, Inc. v. Woodstream Corp.*, 520 F.3d 1337, 1344 (Fed. Cir. 2008); *Leapfrog Ent.*, 485 F.3d at 1161. "[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR Int'l*, 127 S. Ct. at 1740. "Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *Id.* at 1740-41. "[T]he analysis need not seek out precise

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teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *Id.* at 1741. "The obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents." *Id.*

"[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id.* at 1742. It is error to assume that a person of ordinary skill attempting to solve a problem will be led only to those elements of prior art designed to solve the same problem. *See id.* "[I]n many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle" as they are "a person of ordinary creativity, not an automaton." *Id.* If there was a design need and there are a finite number of identified predictable solutions, the fact that a combination of elements from multiple sources was obvious to try might show that it was obvious under 35 U.S.C. § 103. *See id.*

This flexible inquiry into the question of obviousness "*requires* consideration of common knowledge and common sense." *See id.* at 1743 (*citing with approval DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.,* 464 F.3d 1356, 1367 (2006)) (emphasis in the original). A motivation to combine, therefore, may be found *implicitly* in the prior art. *KSR Int'l*, 126 S. Ct. at 1743 (*citing with approval Alza Corp. v. Mylan Labs., Inc.,* 464 F.3d 1286, 1291 (2006)) (emphasis in the original). There is no requirement that any prior art reference contain an actual teaching to combine. *Id.*

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B. **Dr. Rangayyan's Testimony That the '381 Patent Is Obvious Should Not Be Excluded**

1. **Polaroid's Motion Should Be Denied Because Its Arguments Are Not Properly The Basis for Exclusion of Testimony Under *Daubert***

Polaroid's Motion should be denied. Although characterized as a motion attacking the adequacy of Dr. Rangayyan's methodology, it is actually an assertion that there is insufficient evidence of motivation to combine for a Jury to find the asserted claims obvious in light of the combinations discussed by Dr. Rangayyan.[2] Polaroid does not, and could not, assert that Dr. Rangayyan did not understand that evidence of motivation to combine was a part of the obviousness analysis. *See* Polaroid's Motion, p. 4 (*citing* Dr. Rangayyan's report, in which he states expressly his understanding that "a claim is obvious if one of ordinary skill in the art would be motivated to modify an item of prior art, to combine two or more items of prior art to arrive at the claimed invention."). Thus, unlike the case previously decided by this court, which apparently served as a template for Polaroid's Motion, this is *not* a case where an expert has conducted an analysis without regard to the legal principles applicable to the analysis.[3]

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[2] Hence Polaroid's heavy reliance on cases resolving obviousness questions on Summary Judgment. *See, e.g.,* Polaroid's Motion, pp. 3 (*citing Innogenetics , N.V. v. Abbott Labs.*, 512 F.3d 1363 (Fed. Cir. 2008)); 5 (*citing Omegaflex, Inc. v. Parker-Hannifin Corp.*, 243 F.App'x 592 (Fed. Cir. 2007)); 7 (*citing Izumi Prods. Co. v.Koninklijke Philips Elecs. N.V.*, 315 F.Supp.2d 589 (D.Del. 2004))); 8 (*citing KB Home v. Anares Homes, Ltd.,* Civil Action No. 3-04-CV-1031-L, 2007 WL 1893370, at *1 (N.D. Tex. June 28, 2007)); *passim* (*citing KSR Int'l*, 127 S.Ct. 1727).

[3] Dr. Rangayyan's report cannot be reasonably be compared to the expert disclosure at issue in *TruePosition, Inc. v. Andrew Corp.*, 2007 WL 2429415, at *1 (D. Del. Aug. 23, 2007). As the Court may recall, in *TruePosition,* the defendant's invalidity expert failed to consider or adopt either parties' claim constructions, and also failed to provide description of the hypothetical claim construction which allegedly was used to compare the scope of the claims at issue to a prior art reference. *See id*. Further, defendant's expert in *TruePosition* admittedly failed to identify in his claim construction any structure in the specification that perform any function recited in the means plus function claims. *See* Memorandum in Support of TruePosition's Motion to Exclude the Invalidity Testimony of Dr. Davis Goodman Pursuant to Federal Rule of Evidence 702, p. 17. He failed to compare any algorithm disclosed in the specification with the

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In essence, Polaroid is arguing that Dr. Rangayyan's detailed explanations as to how the prior art disclosed each element of the asserted claims and that those elements would have been (and often were actually) used interchangeably by persons of skill in the art are not enough to support an obviousness defense. Polaroid is, of course, entitled to make that argument at trial. At that time, the jury and Court will resolve the fact and legal issues in light of Dr. Rangayyan's testimony (and the testimony of Polaroid's expert). However, complaints about the sufficiency of evidence are not grounds for exclusion of expert testimony under the standards set for in *Daubert. See Walker v. Gordon,* 46 F. App'x 691, 695 (3d Cir. 2002) (in performing its gatekeeping function to determine whether an expert's report is relevant and reliable under *Daubert* and Rule 702, "the court is not to weigh the evidence relied upon or determine whether it agrees with the conclusions reached therein.... [d]eterminations regarding the weight to be accorded, and the sufficiency of, the evidence relied upon by the proffered expert are within the sole province of the jury") (citing *Breidor v. Sears, Roebuck & Co.,* 722 F.2d 1134, 1138-39 (3d Cir. 1983).

Polaroid has made arguments about the sufficiency of the evidence regarding motivation to combine in its Motion For Summary Judgment That Claims 1-3 of U.S. Patent 4,829,381 Are Not Obvious. In its opposition to that Motion, HP has directed the Court to detailed evidence provided by the references themselves and in Dr. Rangayyan's reports that describe in each instance what is taught by the prior art references and why there existed a motivation to combine

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allegedly anticipating prior art reference. *See id.* p. 18. In the present case, Dr. Rangayyan took into account (and for purposes of his analysis adopted) each of the parties competing claim constructions and provided detailed opinions in the alternative. *See, e.g.*, Rangayyan Report, ¶¶ 133-134. Dr. Rangayyan performed the required detailed comparison of the means-plus-function claims to the prior art. *See, e.g., id.* at ¶¶ 204-243, 287-305. Most importantly, as described more fully below Dr. Rangayyan utilized the exact same standard for obvious as required by the Supreme Court in *KSR.*

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them. HP respectfully directs the Court to those portions of its opposition that evidence further

examples of Dr. Rangayyan's analysis – which, as described below, clearly applied the correct

legal standard and took into account the motivation to combine the references. *See* HP's

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Patent Are Not Obvious, pp. 15-28.

  2. **Polaroid's Motion Should Be Denied Because It Fails to Address Evidence of Obviousness Based On A Single Reference – In Which Motivation To Combine Is Irrelevant**

  Polaroid's Motion does not address HP's allegations of obviousness based on the Okada

patent alone. As explained in detail in HP's Motion for Summary Judgment of Non-

Infringement, or in the Alternative, Patent Invalidity, all of the asserted claims of the '381 patent,

including Claims 1-3, are invalid as obvious in light of the Okada patent in view of Polaroid's

contentions regarding the scope of those claims. Polaroid's failure to address the issues and

arguments regarding the Okada reference - and Dr. Rangayyan's discussion of the obviousness

of the asserted claims in light of that reference - are sufficient grounds, without more, to deny

Polaroid's Motion to Exclude.

  3. **Polaroid's Motion Should Be Denied Because Dr. Rangayyan Applied The Correct Legal Standard**

  The Supreme Court has recently explained that, when a patent claims a structure already

known in the prior art that is altered by the mere substitution of one element for another known

in the field, the combination must do more than yield a predictable result to be patentable." *See*

KSR Int'l, 126 S. Ct. at 1740 (internal citations omitted). That is exactly the standard that Dr.

Rangayyan applied in determining whether the asserted claims are obvious in light of various

combinations of prior art references. His report states:

  I have also been told that a claim is "obvious" if one of ordinary skill in the art
  would be motivated to modify an item of prior art, to combine two or more items

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of prior art to arrive at the claimed invention. When a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is likely to be obvious. In certain circumstances, the fact that a combination was obvious to try might show that it was obvious. For example, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.

Rangayyan Report, ¶ 133.

In general, Dr. Rangayyan explains in his reports that each and every element of the asserted claims are disclosed in the prior art. *See, e.g.,* Rangayyan Report, ¶¶ 204-236. Dr. Rangayyan explains, the prior art references are addressed to the same image enhancement problems and objectives. *See id.* at ¶¶ 37-38, 53-55, 65, 73, 75, 81-82, 91-99, 101-102, 118-119. Dr. Rangayyan explains how the values used in claims of the '381 patent to enhance an image - including an average of values associated with a group of surrounding pixels, and the mid-point of the dynamic range of an image - all were commonly used in prior art contrast enhancement techniques. *See, e.g., id.* at ¶¶ 164-172. Dr. Rangayyan describes the mathematical techniques that were used to improve digital images and also explains that a person of ordinary skill in the art would understand the mathematical implications of utilizing these values in algebraic functions, like those claimed in the '381 patent. *See id.* at ¶¶ 60-62, 69-72, 79-80, 85-87, 93-96, 105-107, 116-117, 235; *see also* Declaration of Dr. Rangaraj Rangayyan In Support of Hewlett-Packards Opposition to Polaroid's Motion For Summary Judgment That Claims 1-3 of U.S. Patent No. 4,829,381 Are Not Obvious ("Rangayyan Decl.") at D.I. 190, ¶¶ 9-10. Dr. Rangayyan also explains that a person of ordinary skill in the art would, as a matter of course, understand the utility of swapping out certain algebraic expressions from one reference and combining them with algebraic expressions found in other references. *See* Rangayyan Decl., ¶¶ 9-10. In his deposition Dr. Rangayyan explained:

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Deposition of Dr. Rangaraj Rangayyan dated May 9, 2008 ("Rangayyan Dep.") (Scott Decl. Ex.
C), 227:3-227:10.

As Dr. Rangayyan points out, substitutions of this type are found on the face of the

certain of the references upon which he relies. *See* Rangayyan Dep., 220:21-221:3, 224:19-

225:1 (in both instances discussing how the Lee referenced evidences the substitution of linear

and non linear components into the same base contrast enhancement function). These sorts of

substitution of known variables (such as local averages) in known algebraic expressions produce

highly predictable results. For example, if a person of ordinary skill in the art wanted to take a

known contrast enhancement function like $Y_{out} = X^\gamma$ (disclosed in the Okada reference) and

cause it to be adaptive to local image conditions; it would not take a flash of genius to utilize a

value equal to the average value of the local surrounding pixels in such an equation. *See*

Rangayyan Supplemental Report, ¶ 17. Thus, in general, Dr. Rangayyan opines that the

techniques claimed in the '381 patent are no more than the combination of already known

elements (including known measurements of various image qualities – both local and global) in

known ways (placing them in gamma-correction power-law functions long-known in the art –

e.g. the Okada reference) to achieve results that are easily predictable by a person of ordinary

skill in the image enhancement art (*e.g.* changing an exponent from a value greater than one to a

fraction will produce the curves of the type described in the patent). *See id.* at ¶¶ 43, 83, 123,

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Dr. Rangayyan's application of the legal standard as articulated in *KSR* is evidenced by his extensive analysis of the prior art references that resulted in the opinions described above. Because Dr. Rangayyan conducted an appropriate obviousness analysis he explained in detail why there was a motivation to combine the references upon which he relied. Dr. Rangayyan's two reports, and his declarations in support of HP's Opposition to Polaroid's Motion for Summary Judgment of Non-Obviousness all contain such details.

For example, Dr. Rangayyan explains that:

- In digital image processing courses taught to university students from 1983 to 1987, a typical student would learn and understand digital image processing techniques such as those disclosed in the Okada, Lee, Rangayyan, Wang, Narendra, Richard and Iida references. Therefore, prior to the filing of the application which matured into the '381 patent, the well known aspects of the art of digital image processing included: (i) the use of various mathematical techniques to determine an average of values associated with a selected group of pixels, including the pixel being processed; (ii) choosing a gamma transfer function based on the average value of a neighborhood of pixels adjacent to the pixel being processed; (iii) use of a ratio in a contrast enhancement transformation function; (iv) the use of mathematical transfer functions that utilized ratios of a local average over a value within the available dynamic range; and (v) the transformation of the pixel being processed based on the gamma value produced by the gamma transfer function. *See* Rangayyan Report, ¶ 121.

- As a survey article, Wang shows that different techniques for image processing use similar constituent parts to achieve contrast enhancement and that those parts are often used, or are attempted to be used, interchangeably. *See id.* at ¶ 81.

- Because of the references are directed towards image processing systems/methods, it would be obvious to combine any of these teachings to a problem in image processing. *See id.* at ¶¶ 37-121.

- The teachings of each of the prior art references were well-known to persons skilled in the art at the time of filing of the '381 patent, as was the use of the disclosed techniques in combination. *See id.* at ¶ 121.

- A person of ordinary skill in the art would look to the component disclosures of prior art and appreciate their usefulness in combination with components taught elsewhere. *See* Rangayyan Decl., ¶ 8.

- A person of ordinary skill in the art, would understand that the various elements disclosed by a reference – such as the mathematical algorithms utilized in a

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contrast enhancement method – could be combined with elements from other references to perform contrast enhancement functions with specific characteristics. *See id.* at ¶ 9.

- A person of ordinary skill in the art would understand the implications of particular mathematical expressions used in contrast enhancement algorithms and be able to predict the effect that use of those expressions, alone or in combination with other mathematical expressions, would have on a contrast enhancement algorithm. *See id.* at ¶ 9.

- A person of ordinary skill in the art would appreciate the effect of different mathematical operations and expressions on a contrast enhancement algorithm – such as the use of exponential expressions (or "power-law" functions). A person of ordinary skill would be adept at modifying algebraic functions and predicting the effects of such modifications on the resulting contrast enhancement algorithm. As a result, it would be both trivial and expected that someone of ordinary skill in the art would modify linear contrast enhancement functions to use exponential (or "power-law") expressions. *See id.* at ¶ 12.

Dr. Rangayyan then goes on to further detail – in the context of each specific combination of references – how such a combination would occur and why there would be motivation to combine. Examples of such explanations from his reports include:

- "I believe that it would have been obvious to try modifying the gain factor taught by Gonzalez to further increase the contrast of luminance levels in very dark or very light areas of the image. It would be obvious to identify very dark and very light areas of the image by using the mean value of the neighboring pixels. In this way the gain would increase in areas of low light or high light." Rangayyan Report, ¶ 192.

- "Lee teaches a function $g(x)=ax+b$, where a=0.9 and b=13 'to allow contrast enhancement at both ends of gray scale.' (Lee, p. 166, col. 1, last paragraph). 'The linear function … yields an effective constant stretch in both the highlights and the dark areas of the image.' (*Id.*) I believe it would have been obvious to try replacing the linear function taught by Lee with a function that increased the "stretch" in areas of very low light or very high light, because that would allow Lee to further increase contrast at both ends of the gray scale." Rangayyan Report, ¶ 193.

- "I believe that one of ordinary skill in the art would have found it obvious to modify the techniques of Rangayyan to try to use a gain factor, as described by any one of the references above, to increase contrast in a processed image." *Id.* at ¶ 312.

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- "As each of the references is directed to systems and methods of contrast enhancement, I also believe it would be an obvious extension to Iida to use any one of the gain factors taught by Gonzalez, the Gonzalez algorithm, Richard, Lee, Sabri, Rangayyan, Chen, Narendra or Wang." Rangayyan Supplemental Report, ¶ 137.

- "The Gonzalez algorithm operates on the input pixel itself, without taking an average. However, as I observe directly above, using a block average or low-pass filter in the context of a contrast enhancement was well-known, as taught by any one of Gonzalez, Richard, Lee, Sabri, Rangayyan, Chen or Narendra. It would have been obvious to include the averages taught by those references in the Gonzalez algorithm to provide for local, rather than global, contrast. (Gonzalez, p. 160)." Rangayyan Report, ¶ 230.

- "It is my opinion that combining the "means for selecting and transforming" of the Gonzalez algorithm with the image processing systems and methods described by Gonzalez [in the same text] is no more than arranging elements already well-known in the image processing field. Furthermore, the elements would continue to serve the same purpose and perform the same function in the proposed combination as they did in the Gonzalez reference and the Gonzalez algorithm. Therefore, I am of the opinion that claim 1 is obvious, as that term has been explained to me, over Gonzalez in combination with the Gonzalez algorithm." Rangayyan Report, ¶ 238; *see also* ¶¶ 239-242.

- "Gonzalez teaches selecting a transfer function to provide higher contrast between a pixel and its neighbors pixels when a calculated intermediate value represents a very dark or very light condition (Gonzalez, p. 141). Gonzalez teaches multiplying the difference between the value of an input pixel and the mean value of the neighboring pixels by a gain factor, $A(x,y)$. (Gonzalez, Eq. 4.2-14). The gain factor is calculated by multiplying a constant, k, by the global mean of pixel values for the image and dividing that result by the standard deviation of neighborhood pixel values from the mean value for the neighborhood of pixels. (Gonzalez, Eq. 4.2-15). This results in a gain that varies based on the standard deviation of the neighborhood pixel values, because k is a constant and the global mean, M, is a constant value for an image. I believe that it would have been obvious to try modifying the gain factor taught by Gonzalez to further increase the contrast of luminance levels in very dark or very light areas of the image. It would be obvious to identify very dark and very light areas of the image using the mean value of the neighboring pixels. In this way the gain would increase in areas of low light or high light. Therefore, I believe that claim 8 is obvious in view of Gonzalez." Rangayyan Report, ¶ 192.

- "Lee teaches selecting a transfer function to provide higher contrast between the value of a pixel and its neighbors when a calculated intermediate value represents a very dark condition or a very light condition. Lee teaches a function $g(x)=ax+b$, where a=0.9 and b=13 "to allow contrast enhancement at both ends of gray scale." (Lee, p. 166, col. 1, last paragraph). 'The linear function … yields

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an effective constant stretch in both the highlights and the dark areas of the image.' (*Id.*) I believe it would have been obvious to try replacing the linear function taught by Lee with a function that increased the 'stretch' in areas of very low light or very high light, because that would allow Lee to further increase contrast at both ends of the gray scale. Therefore, I believe claim 8 is an obvious extension of Lee." Rangayyan Report, ¶ 193; *see also* ¶ 249.

- "Narendra teaches that the local area mean is subtracted from the value of a pixel being processed and a gain is applied to the difference. (Narendra, p. 656, col. 2, second paragraph). The gain taught by Narendra is calculated by multiplying a constant, α., by the global mean of pixel values for the image and dividing that result by the standard deviation of neighborhood pixel values from the mean value for the neighborhood of pixels. This results in a gain that varies based on the standard deviation of the neighborhood pixel values, because α is a constant and the global mean, M, is a constant value for an image. I believe that it would have been obvious to try modifying the gain factor taught by Narendra to further increase the content of luminance levels in very dark or very light areas of the image. It would be obvious to identify very dark and very light areas of image using the mean value of the neighboring pixels. In this matter the gain would increase in areas of low light or high light. Therefore, I believe claim 8 is obvious in view of Narendra." Rangayyan Report, ¶ 194; *see also* ¶ 250.

- "Wang teaches selecting a transfer function to provide higher contrast between the value of a pixel and its neighbors when a calculated intermediate value represents a very dark condition or a very light condition. Wang teaches a function $g(x)=ax+b$, where $a=0.9$ and $b=13$ "to allow contrast enhancement at both ends of gray scale." (Wang, p. 166, col. 1, last paragraph). "The linear function … yields an effective constant stretch in both the highlights and the dark areas of the image." (*Id.*) I believe it would have been obvious to try replacing the linear function taught by Lee with a function that increases the "stretch" in areas of very low light or very high light, because that would allow Wang to further increase contrast at both ends of the gray scale." Rangayyan Report, ¶ 195.

- "Gonzalez teaches selecting a transfer function to provide higher contrast between a pixel and its neighbors pixels when a calculated intermediate value represents a very dark or very light condition (Gonzalez, p, 141). Gonzalez teaches multiplying the difference between the value of an input pixel and the mean value of the neighboring pixels by a gain factor, $A(x,y)$. (Gonzalez, Eq. 4.2-14). The gain factor is calculated by multiplying a constant, k, by the global mean of pixel values for the image and dividing that result by the standard deviation of neighborhood pixel values from the mean value for the neighborhood of pixels. (Gonzalez, Eq. 4.2-15). This results in a gain that varies based on the standard deviation of the neighborhood pixel values, because k is a constant and the global mean, m, is a constant value for an image. I believe that it would have been obvious to try modifying the gain factor to adapt to relative light levels in the image. By replacing the constant, k, with the mean value of the neighboring

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pixels so that the gain would increase in areas of low light or high light. Therefore, I believe that claim 8 is obvious in view of Gonzalez." Rangayyan Report, ¶ 246.

- "Gain factors are well-known in the art, see, e.g., Gonzalez, Richard, Lee, Sabri, Narendra and Wang. Gonzalez teaches that the transfer function is computed with a determined constant k, which is determined to be a value in the range between 0 and 1 and which controls the gain. (Gonzalez, p. 160, Equation (4.2-15)). Richard teaches a system in which a constant value, K, can be determined by an operator to control the contrast applied to an image. (Richard, col. 5, lines 55-58). Lee teaches an algorithm in which the new pixel value, $x'_{i,j}$, is equal to the local mean, $m_{i,j}$ plus the input pixel value minus the local mean, $x_{i,j}$-m_{ij}, multiplied by a determined gain factor, k. k, therefore, controls the gain. (Lee, p.166, col. 1, Eq. 4). Chen teaches using a constant k for adjusting the contrast calculated by the selected transfer function. (Chen, col. 1, lines 22-49). Sabri teaches using determined constants to control contrast enhancement. (Sabri, col. 2, lines 29-39). Narendra teaches a transfer function using a locally adaptive gain factor based on a determined constant. The constant, therefore, controls the gain. (Narendra, p. 656, col. 2., Equation (1)). Wang teaches using the contrast gain factor of a determined constant k. (Wang, p. 376, Equation (6-4)). I believe that one of ordinary skill in the art would have found it obvious to modify the techniques of Rangayyan to try to use a gain factor, as described by any one of the references above, to increase contrast in a processed image." Rangayyan Report, ¶ 312.

- "It is my opinion that combining any one of the "means for selecting and transforming" of the Gonzalez algorithm, Wang or Okada with the image processing systems and methods described by Gonzalez is no more than arranging elements already well-known in the image processing field. Furthermore, the elements would continue to serve the same purpose and perform the same function in the proposed combination as they did in the Gonzalez reference and each of the Gonzalez algorithm, Wang or Okada references. Therefore, I am of the opinion that claim 1 is obvious, as that term has been explained to me, over Gonzalez in combination with the Gonzalez algorithm. I am also of the opinion that claim 1 is obvious, as that term has been explained to me, over Gonzalez in combination with Wang. I am further of the opinion that claim 1 is obvious, as that term has been explained to me, over Gonzalez in combination with Okada." Rangayyan Supplemental Report, ¶ 116.

- It is my opinion that combining any one of the "means for selecting and transforming" of the Gonzalez algorithm, Wang or Okada with the image processing systems and methods described by Lee is no more than arranging elements already well-known in the image processing field. Furthermore, the elements would continue to serve the same purpose and perform the same function in the proposed combination as they did in the Lee reference and each of the Gonzalez algorithm, Wang or Okada references. Therefore, I am of the opinion that claim 1 is obvious, as that term has been explained to me, in view of

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Lee in combination with the Gonzalez algorithm. I am also of the opinion that claim 1 is obvious, as that term has been explained to me, over Lee in combination with Wang. I am further of the opinion that claim 1 is obvious, as that term has been explained to me, over Lee in combination with Okada. Rangayyan Supplemental Report, ¶ 117.

- It is my opinion that combining any one of the "means for selecting and transforming" of the Gonzalez algorithm, Wang or Okada with the image processing systems and methods described by Chen is no more than arranging elements already well-known in the image processing field. Furthermore, the elements would continue to serve the same purpose and perform the same function in the proposed combination as they did in the Chen reference and each of the Gonzalez algorithm, Wang or Okada references. Therefore, I am of the opinion that claim 1 is obvious, as that term has been explained to me, in view of the Chen reference in combination with the Gonzalez algorithm. I am also of the opinion that claim 1 is obvious, as that term has been explained to me, over Chen in combination with Wang. I am further of the opinion that claim 1 is obvious, as that term has been explained to me, over Chen in combination with Okada. Rangayyan Supplemental Report, ¶ 120; *see also* ¶ 121 (same statement as to other combination).

- "As explained above in connection with claim 9 under Polaroid's construction, each of the references of Gonzalez, the Gonzalez algorithm, Richard, Lee, Sabri, Rangayyan, Chen, Narendra, and Wang contains, and thus teaches, a number that may be increased to increase the amount of contrast enhancement that is performed in areas of the image where higher contrast has been provided by the transfer function. I believe it would be an obvious extension to Iida to use any of the numbers that increase contrast as described above in view of any one of Gonzalez, the Gonzalez algorithm, Richard, Lee, Sabri, Rangayyan, Chen, Narendra or Wang. As stated in my initial report, gain factors are well-known in the art, see, e.g., Gonzalez, Richard, Lee, Sabri, Narendra and Wang. (HP's Expert Report On Invalidity, paragraphs 311-312). As each of the references is directed to systems and methods of contrast enhancement, I also believe it would be an obvious extension to Iida to use any one of the gain factors taught by Gonzalez, the Gonzalez algorithm, Richard, Lee, Sabri, Rangayyan, Chen, Narendra or Wang." Rangayyan Supplemental Report, ¶ 137.

- "It is my opinion that combining any of the image processing system of Gonzalez, Richard, Lee, Sabri, Rangayyan, Chen, Narendra, Wang and Okada with the image processing system of the Gonzalez algorithm is no more than arranging elements already well-known in the image processing field. Furthermore, the elements would continue to serve the same purpose and perform the same function in the proposed combination as they did in the Gonzalez algorithm and each of the respective references. Therefore, I am of the opinion that claim 1 is obvious, as that term has been explained to me, over the Gonzalez algorithm in combination with any one of the references of Gonzalez, Richard,

Lee, Sabri, Rangayyan, Chen, Narendra, Wang and Okada." Rangayyan Supplemental Report, ¶ 191.

Thus, Dr. Rangayyan has explained in detail how the asserted claims are no more than the arrangement of old elements, with each performing the same function it had been known to perform, yielding only what a person of ordinary skill would expect. Such an analysis is exactly what is required to determine whether a claim is obvious. *See KSR Int'l*, 127 S. Ct. at 1740. As Dr. Rangayyan unquestionable conducted an appropriate analysis utilizing the very standard laid out by the Supreme Court in *KSR*, Polaroid's Motion should be denied. Polaroid may disagree with Dr. Rangayyan's analysis, and may offer its own, but this is not a reason for the Court to prevent Dr. Rangayyan from presenting and explaining his opinions.[4]

Conclusion

For the reasons stated above, Polaroid's Motion to Exclude Dr. Rangayyan's testimony regarding Obviousness should be denied because Dr. Rangayyan performed the appropriate analysis and applied the correct legal standards. Further, Polaroid's complaints regarding the quality of Dr. Rangayyan's opinions regarding motivation to combine are not grounds for exclusion under *Daubert*. At most, they create material issues of fact to be resolved at trial.

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[4] There is no question that Dr. Rangayyan's explanations are relevant to the question of motivation to combine. The Court and the jury should hear the evidence and make their own determination as to whether motivation to combine the references in question existed. *See Walker,* 46 F. App'x at 695.

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Dated: June 12, 2008   **FISH & RICHARDSON P.C.**

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CERTIFICATE OF SERVICE

I hereby certify that on June 12, 2008, I electronically filed with the Clerk of Court the

foregoing document using CM/ECF which will send electronic notification of such filing(s) to

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